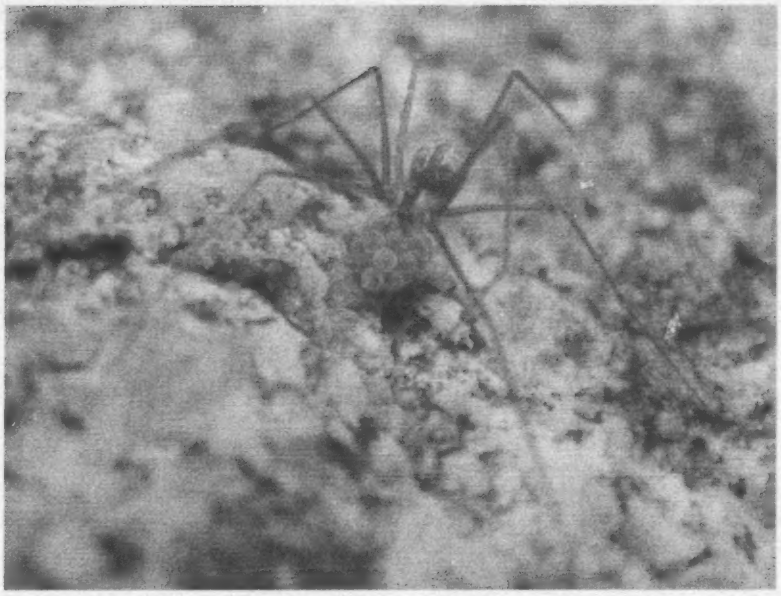
COSEWIC
Assessment and Status Report

on the

Northwestern Cellar Spider
Psilochorus hesperus

in Canada



NOT AT RISK
2014

COSEWIC
Committee on the Status
of Endangered Wildlife
in Canada

COSEPAC
Comité sur la situation
des espèces en péril
au Canada

COSEWIC status reports are working documents used in assigning the status of wildlife species suspected of being at risk. This report may be cited as follows:

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COSEWIC would like to acknowledge Dr. Robb Bennett for writing the status report on the Northwestern Cellar Spider, *Psilochorus hesperus*, in Canada, prepared under contract with Environment Canada. This report was overseen and edited by Jennifer Heron, Co-chair of the COSEWIC Arthropods Specialist Subcommittee.

For additional copies contact:

COSEWIC Secretariat
c/o Canadian Wildlife Service
Environment Canada
Ottawa, ON
K1A 0H3

Tel.: 819-953-3215
Fax: 819-994-3684
E-mail: COSEWIC/COSEPAC@ec.gc.ca
http://www.cosewic.gc.ca

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COSEWIC
Assessment Summary

Assessment Summary – May 2014

Common name
Northwestern Cellar Spider

Scientific name
Psilochorus hesperus

Status
Not at Risk

Reason for designation
This small, rare spider is one of only two native cellar spiders in Canada. The species has a restricted range within bunchgrass- and Ponderosa Pine-dominated ecosystems and is found only within a specific habitat within these ecosystems. It requires cool, humid microhabitats beneath large rocks that enable its survival in otherwise hot and dry environments. This species has limited dispersal ability and small population sizes within isolated rocky habitats. Sites and habitats are potentially at risk from urban and agricultural development, road construction, and utility corridor maintenance activities. However, overall threats to the specific rocky habitats of the species are considered to be low at present. Furthermore, there is extensive potential habitat in the Similkameen and Okanagan Valleys that has not been surveyed for the species. These considerations resulted in the designation of Not at Risk.

Occurrence
British Columbia

Status history
Designated Not at Risk in May 2014.

COSEWIC
Executive Summary

Northwestern Cellar Spider
Psilochorus hesperus

Wildlife Species Description and Significance

Psilochorus hesperus (Northwestern Cellar Spider) is a cellar spider (Family Pholcidae) characterized by specialized copulatory structures, basally fused jaws and six of their eyes arranged in a pair of distinctive triads. The species has long and spindly legs, a small body size, Y-shaped groove on the head, distinctive spurs on the male jaws and bovine-udder-like female genitalia. This spider has limited dispersal abilities.

Cellar spiders derive their name from the human structures in which some of the species in this family are commonly found: undisturbed dark crevices within buildings, homes, basements and cellars. However, only a fraction of the 1350 named species occur within anthropogenic habitats. Most species live in natural habitats that include caves, under rocks and in abandoned mammal burrows. *Psilochorus hesperus* has not been found in basements or cellars.

Distribution

Psilochorus hesperus ranges from eastern California through Nevada, Idaho, Utah, Washington to southern interior British Columbia. In Canada the spider is restricted to the Western Interior Basin within British Columbia in a small area of the lower Similkameen and south Okanagan Valleys. The species is one of only two native pholcid spiders in Canada. An additional non-native pholcid species ranges in BC.

Habitat

Psilochorus hesperus inhabits low-elevation valley bottoms within the hot dry bunchgrass, Douglas-fir and Ponderosa Pine ecosystems of the southern interior of British Columbia. The species' microhabitat includes the undersurfaces of relatively large, stable rocks, which provide some protection from temperature extremes. Occupied rocky areas are typically those situated in cooler habitats that are north- or east-facing and have a component of open forest or shrub which provides shading. The species likely wanders from its rocky residences in the cooler night temperatures and thus requires vegetation or other unqualified habitat elements adjacent to occupied rocky areas.

Biology

Psilochorus hesperus has a one-year life cycle. Individuals spend their lives within small territorial spaces under the surface of suitable rocks. Adult females and juveniles overwinter although adult females are present year-round (various age classes) and some may overwinter twice; adult males and new adult females mature in early spring; adult males are unlikely to be encountered after late summer. Mated females may produce several egg sacs, one at a time. Each egg sac is a loosely bound ball of up to two dozen eggs carried in the mother's jaws. The extended egg production period results in a series of juvenile age classes within a population. Dispersal to new rock habitats is by nocturnal wandering for relatively short distances from areas of occupied rock habitat.

Population Sizes and Trends

Population size and trends are unknown.

Threats and Limiting Factors

The primary threat is the conversion of natural habitat to urban and agricultural development, and road construction and maintenance activities along transportation and service corridors. A combination of wildfires, water management activities, landslides, and pesticides also threaten the species. Limiting factors include small population sizes at occupied sites and isolation from other populations; widely separated areas of unsuitable habitat; and limited dispersal abilities that may prevent recolonization of new areas.

There are at least 16 locations: eight in the lower Similkameen Valley and eight in the south Okanagan Valley. One site at Summerland (Okanagan Valley) is situated in an artificial rock wall within a cemetery and considered a result of movement of material by humans. This site is still considered extant and included in the number of locations. An additional site in the Okanagan Valley was converted to agricultural use and is presumed extirpated, although the area has not been re-surveyed. There is a small possibility of unrecorded populations in adjacent habitats.

Habitat Protection and Ownership

Psilochorus hesperus has been recorded within provincially owned protected areas including the South Okanagan Grasslands Protected Area (East Chopaka site) and Haynes Ecological Reserve. One site is on a roadway adjacent to a private conservation property owned by The Nature Trust, and the spider is likely also present within this protected area. Most sites are on unprotected provincial Crown (e.g., roadsides or forestry land) or First Nations land.

Psilochorus hesperus is not protected by federal or provincial legislation. The species does not have a global rank (GNR). The Canadian and British Columbia General Status ranks of "2" (may be at risk) applied. The draft national status rank is N2 (imperilled) and the provincial is S2 as well.

TECHNICAL SUMMARY

Psilochorus hesperus
Northwestern Cellar Spider — Pholcide de l'Ouest
Range of occurrence in Canada: British Columbia

Demographic Information

Generation time	1 year
Is there an [observed, inferred, or projected] continuing decline in number of mature individuals? • Inferred decline based on cumulative habitat loss and degradation within the Okanagan Valley; magnitude unknown.	Inferred decline, but magnitude unknown.
Estimated percent of continuing decline in total number of mature individuals within [5 years or 2 generations]	Unknown
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over the last [10 years, or 3 generations].	Unknown
[Projected or suspected] percent [reduction or increase] in total number of mature individuals over the next [10 years, or 3 generations].	Unknown
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over any [10 years, or 3 generations] period, over a time period including both the past and the future. • No temporal data on populations are available. Inferred reduction based on threats from urban and agricultural land conversion.	Inferred reduction based on habitat loss and degradation
Are the causes of the decline clearly reversible and understood and ceased? • The threat of urban and agricultural land conversion is understood and will continue.	Causes of decline not reversible; partially understood and not ceased.
Are there extreme fluctuations in number of mature individuals?	Unknown.

Extent and Occupancy Information

Estimated extent of occurrence • 2376 km² - all Canadian records • 1773 km² - excludes north Okanagan cemetery site	1773 – 2376 km²
Index of area of occupancy (IAO) (2x2 grid value) • 68 km² based on 17 known sites; • 5-10 potential unrecorded sites expected from future surveys	68 km²
Is the population severely fragmented?	Unknown
Number of locations* • The species is likely with an additional ten locations.	> 16

* See Definitions and Abbreviations on COSEWIC website and IUCN 2010 for more information on this term.

Is there an [observed, inferred, or projected] continuing decline in extent of occurrence? • Inferred decline based on habitat loss and degradation	Yes, inferred.
Is there an [observed, inferred, or projected] continuing decline in index of area of occupancy? • Inferred decline based on some habitat loss and degradation, although there is potential unchecked habitat.	Yes, inferred.
Is there an [observed, inferred, or projected] continuing decline in number of populations?	Unknown.
Is there an [observed, inferred, or projected] continuing decline in number of locations*? Similkameen Valley sites are likely stable. Okanagan Valley sites have inferred decline based on some habitat loss and degradation.	Unknown.
Is there an [observed, inferred, or projected] continuing decline in [area, extent and/or quality] of habitat? Observed decline in habitat quality and habitat area, with destruction of habitat for residential, industrial, and (especially) agricultural uses ongoing.	Yes, observed and inferred.
Are there extreme fluctuations in number of populations?	Not likely.
Are there extreme fluctuations in number of locations*?	Not likely.
Are there extreme fluctuations in extent of occurrence?	No
Are there extreme fluctuations in index of area of occupancy?	No

Number of Mature Individuals (in each population)

Population	N Mature Individuals
Total	Unknown

Quantitative Analysis

Probability of extinction in the wild is at least [20% within 20 years or 5 generations, or 10% within 100 years].	Unknown

Threats (actual or imminent, to populations or habitats)

The predominant threat is habitat destruction resulting from conversion of land to residential, industrial, and agricultural uses. Habitat loss could include large-scale land clearing (e.g., housing subdivision) or specific rocky substrate extraction (e.g., road construction materials) or road building (e.g., blasting). Other significant threats applicable to most sites are wildfire, landslides, gas pipeline construction and maintenance, and pesticide application.

Rescue Effect (immigration from outside Canada)

Status of outside population(s)? • The species has not been assigned conservation status ranks for adjacent states (WA, OR). • There are more widely distributed records in the US.	Unknown.

* See Definitions and Abbreviations on COSEWIC website and IUCN 2010 for more information on this term

Is immigration known or possible? • Transportation by humans may be possible. Immigration via natural dispersal mechanisms is unknown.	Unknown, but possible.
Would immigrants be adapted to survive in Canada? • Survival of immigrants inferred from records at Peach Orchard Cemetery site within otherwise unsuitable habitat.	Yes
Is there sufficient habitat for immigrants in Canada?	Yes
Is rescue from outside populations likely?	Unknown, but possible.

Data-Sensitive Species

Is this a data-sensitive species?	No

Status History

COSEWIC: Designated Not At Risk (2014)

Status and Reasons for Designation:

Status: Not At Risk	**Alpha-numeric code:** Not applicable.
Reasons for designation: This small, rare spider is one of only two native cellar spiders in Canada. The species has a restricted range within bunchgrass- and Ponderosa Pine-dominated ecosystems and is found only within a specific habitat within these ecosystems. It requires cool, humid microhabitats beneath large rocks that enable its survival in otherwise hot and dry environments. This species has limited dispersal ability and small population sizes within isolated rocky habitats. Sites and habitats are potentially at risk from urban and agricultural development, road construction, and utility corridor maintenance activities. However, overall threats to the specific rocky habitats of the species are considered to be low at present. Furthermore, there is extensive potential habitat in the Similkameen and Okanagan Valleys that has not been surveyed for the species. These considerations resulted in the designation of Not at Risk.	

Applicability of Criteria

Criterion A (Decline in Total Number of Mature Individuals): Not applicable. No data on decline.
Criterion B (Small Distribution Range and Decline or Fluctuation): Not applicable. While the EO and IAO are below the thresholds for Endangered, and the overall habitat quality is declining, there are more than 10 locations, the population is not severely fragmented, and there are no extreme fluctuations as far as it is currently known.
Criterion C (Small and Declining Number of Mature Individuals): Not applicable. No data available on population sizes of mature individuals.
Criterion D (Very Small or Restricted Population): Not applicable. No data on population numbers.
Criterion E (Quantitative Analysis): Not applicable. No data available.

COSEWIC HISTORY

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list. On June 5, 2003, the *Species at Risk Act* (SARA) was proclaimed. SARA establishes COSEWIC as an advisory body ensuring that species will continue to be assessed under a rigorous and independent scientific process.

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species, subspecies, varieties, or other designatable units that are considered to be at risk in Canada. Designations are made on native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fishes, arthropods, molluscs, vascular plants, mosses, and lichens.

COSEWIC MEMBERSHIP

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal entities (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biodiversity Information Partnership, chaired by the Canadian Museum of Nature), three non-government science members and the co-chairs of the species specialist subcommittees and the Aboriginal Traditional Knowledge subcommittee. The Committee meets to consider status reports on candidate species.

DEFINITIONS
(2014)

Wildlife Species	A species, subspecies, variety, or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years.
Extinct (X)	A wildlife species that no longer exists.
Extirpated (XT)	A wildlife species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A wildlife species facing imminent extirpation or extinction.
Threatened (T)	A wildlife species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)**	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
Data Deficient (DD)***	A category that applies when the available information is insufficient (a) to resolve a species' eligibility for assessment or (b) to permit an assessment of the species' risk of extinction.

* Formerly described as "Vulnerable" from 1990 to 1999, or "Rare" prior to 1990.

** Formerly described as "Not In Any Category", or "No Designation Required."

*** Formerly described as "Indeterminate" from 1994 to 1999 or "ISIBD" (insufficient scientific information on which to base a designation) prior to 1994. Definition of the (DD) category revised in 2006.

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Canada

The Canadian Wildlife Service, Environment Canada, provides full administrative and financial support to the COSEWIC Secretariat.

COSEWIC Status Report

on the

Northwestern Cellar Spider

Psilochorus hesperus

in Canada

2014

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Figure 2. Female with pale abdomen and carrying an egg sac. White and black lines indicate approximate lengths of body and first leg tibiae respectively. Female photographed as found clinging to the undersides of rocks. Length, exclusive of legs, is approximately 3.3 mm. Photograph Darren Copley. 7

Figure 3. Global range of *Psilochorus hesperus*. Sites within the United States are approximated from the distribution map in Slowik (2009). 9

Figure 4. Canadian range *of Psilochorus hesperus*. Dark circles = all known sites; pale circles = searched sites. Green arrow = cemetery site at Summerland. Red arrows = Okanagan Valley sites with recent surveys (listed from north to south): east shore Skaha Lake (present 1996, undetected 2012), McIntyre Rd. (undetected 2001-2011, present 2012), Kennedy Flats (present 1995, undetected 2009), Haynes Lease/"The Throne" (present 1992 (Haynes Lease), 2001 and 2009 ("The Throne"), undetected 2012), Osoyoos Indian Reserve 1 (present 1995, converted to vineyards later that decade), and Kilpoola Lake (present 2007, undetected 2012). 10

Figure 5. Map of British Columbia showing all *Psilochorus hesperus* records (orange squares); all records of related native cellar spider *Pholocophora americana* in BC (blue triangles; many of these dots also represent a minimum of 1.5 hours search effort) and general spider surveys in British Columbia from 2006 – 2013 (black dots; each dot represents at least 1.5 hours search effort per site). Map created by Alain Filion. 18

Figure 6. South Okanagan Grasslands Protected Area Chopaka East site, ~ 2 km southwest of Kilpoola Lake (west of Osoyoos), July 2012. This population was first recorded in 2008. Many of these rocks harbour *P. hesperus* with northeast exposure and shading from shrubs providing good environmental protection. 21

Figure 7. Suitable habitat for *Psilochorus hesperus* along Old Hedley Road just east of Hayes Creek, ~ 12.5 km east of the junction with Highway 5A near Princeton, July 2012. East view. Many rocks in this image harbour *P. hesperus*. 22

Figure 8. Suitable and unsuitable habitat for *P. hesperus* at the McIntyre Road bluffs immediately east of Vaseux Lake, July 2012. Rocky slope faces southwest. This site has been surveyed for pholcids and other spiders several times between 2001 and 2012. *Psilochorus hesperus* was first observed here in 2012 and only at one site (yellow oval) where rocks are afforded environmental protection by a dense thicket of Saskatoon Serviceberry. Other areas of this slope (white oval) contain unsuitable exposed habitat as well as a significant area of apparently suitable habitat shaded by shrubs and Ponderosa Pines; no *P. hesperus* have been found in those unsuitable or apparently suitable habitats. Presumably the very hot southwestern exposure makes this site and its rock habitats generally unsuitable for *P. hesperus*. 23

Figure 9. Artificial rock wall supporting *P. hesperus* in otherwise unsuitable habitat, Peach Orchard Cemetery, Summerland, July 2012. The cemetery is located on an exposed, hot, east-facing steep slope; adjacent habitat is primarily sagebrush (*Artemesia* sp.) on fine silt soil with no rock. At this site, specimens of *P. hesperus* occur only on the undersides of some of the capping slabs on the cement block retaining walls (other available interstitial spaces are packed with silt). This is the northernmost known site for *P. hesperus* and is more than 35 km north of the McIntyre Road bluffs, the nearest known occupied site. A single mature female (carrying an egg sac) and several juveniles were observed in 2012 24

List of Tables

Table 1. General data on xeric areas of British Columbia surveyed for pholcid spiders 2001-2012. All surveys conducted by R.G. Bennett *et al. Pholcophora americana* was broadly distributed through most of the surveyed area; *Psilochorus hesperus* was restricted to the Similkameen River and parts of the southern Okanagan Valley. See Figure 5 for additional survey sites in BC. 12

Table 2. *Psilochorus hesperus* records in southern British Columbia with 2012 search effort. Abbreviations: CDD – C.D. Dondale; GGES – G.G.E. Scudder; LR – L. Ramsay; RGB – R.G. Bennett; WDC – W.D. Charles. Latitude, longitude, and elevation data from Google Earth 6.1 (Google Inc. 2011). All specimens deposited in the Royal British Columbia Museum (Victoria, BC) except for collections by WDC and GGES identified by CDD which are in the Canadian National Collection of Insects and Arachnids (Ottawa, Ontario) 13

Table 3. Search effort within *P. hesperus* habitat where no specimens were found during targeted surveys. Abbreviations: CC – C. Copley; DC – D. Copley; MF – M. Fairbarns; RGB – R.G. Bennett. Latitude, longitude, and elevation data from Google Earth 6.1 (Google Inc. 2011). Voucher specimens of other species collected at these sites are deposited in the Royal British Columbia Museum, Victoria, BC 16

Table 4. *Psilochorus hesperus* summary of IUCN-CMP Threats applicable to each site. 18

Table 5. IUCN-CMP (World Conservation Union–Conservation Measures Partnership) unified threats classification system. Threats may be observed, inferred, or projected to occur in the near term. Threat "impact" is calculated from scope and severity. For information on how the values are assigned, see Master *et al.* (2009) and for threat classification see CMP (2010). 28

WILDLIFE SPECIES DESCRIPTION AND SIGNIFICANCE

Name and Classification

Class:	Arachnida
Order:	Araneae
Subordinal:	Opisthothelae: Araneomorphae: Haplogynae
Family:	Pholcidae
Subfamily:	Modisiminae
Genus:	*Psilochorus* Simon 1893
Species:	*Psilochorus hesperus* Gertsch and Ivie 1936
English Common Names:	Northwestern Cellar Spider
	Northwestern Longlegged Pholcid
French Common Name:	Pholcide de l'Ouest

The genus *Psilochorus* is part of a New World clade of pholcid (cellar) spiders (Huber 2005, 2011a) and includes over 40 described species (Platnick 2012). The majority of these species have small and restricted ranges within the Nearctic region. Simon (1893) described the genus; Gertsch and Ivie (1936) described *Psilochorus hesperus*; and Slowik (2009) revised the Nearctic species occurring north of Mexico. Huber (2000, 2011a) has analyzed the global phylogeny of pholcids. No subspecies of *P. hesperus* are described.

Although *Psilochorus hesperus* is called a cellar spider, the name is due to taxonomic history rather than habitat association. The first genus described in the family was its namesake taxon, the European *Pholcus* (in 1805). Because of its close association with human habitation, *Pholcus phalangioides* has accidentally been introduced around the world where they are found in undisturbed areas such as basements and cellars. It is for this reason the family is often referred to as cellar spiders, despite the fact that most of the 1300+ named species occur in natural habitats that include caves, under rocks, and in abandoned mammal burrows. In Canada, the only pholcid recorded in homes is this non-native pholcid, *Pholcus phalangioides*. There are no records of *P. hesperus* or the other native pholcid species occurring in association with human habitation.

Morphological Description

Pholcid spiders lack a cribellum (a broad, flat silk production organ located in front of the spinnerets in a variety of spiders) and have haplogyne genitalia (male genitalia feature an exposed genital bulb) on the tarsal (last) segment of each pedipalp (paired leg-like structures in front of the first pair of legs of all spiders, modified for copulation in males, unmodified in females, Fig 1). Female genitalia have a simple plate ventrally on the abdomen and lack the complex copulatory apparatus typical of most female spiders. In addition, pholcids are distinguished by the possession of basally fused chelicerae

(jaws) and eyes arranged in three groups with the anterior median eyes occurring as a pair (or absent in some pholcids; specimens of *Psilochorus* have a full complement of eight eyes) and the other six eyes as distinctive triads.

Psilochorus have long and spindly legs (length of each tibia of the first pair of legs > body length [*versus* ≤ body length]; Figure 1 and 2), small body size (< 4 mm [*versus* > 4 mm]; 3), carapace with a Y-shaped dorsal median groove and each male pedipalp with a pointed structure on the tip of a slender femur (*versus* pointed structure lacking and femur enlarged) and a simple slender procursus (a basal outgrowth on the tip of the pedipalp) (*versus* a much larger and complex procursus).

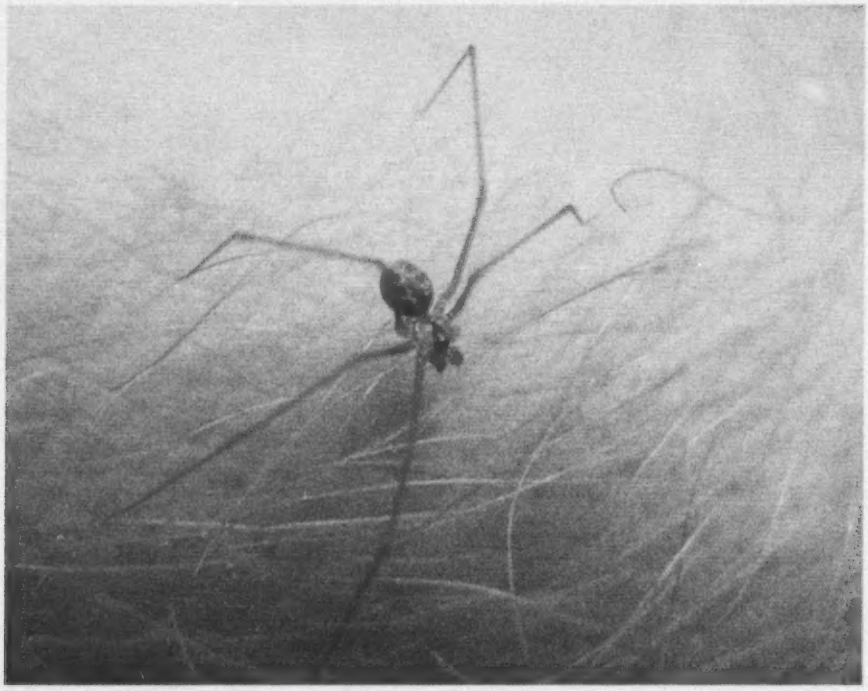

Figure 1. Male (lacking three legs, two from left side, one from right side) on a human forearm. Note copulatory organs (modified pedipalps) in front of the male's face. Length, exclusive of legs, is approximately 2.5 mm. Photograph: Darren Copley.

Males have a sharply pointed, inwardly curved, pair of elongate spurs projecting from the bases of the fused jaws and resembling steer horns; and females have a pair of closely spaced humps on a large prominence projecting ventrally from the copulatory region of the abdomen and resembling a bovine udder.

The following description of *P. hesperus* is summarized from Slowik (2009). Specimens are small (body length 2.5 mm [males, Figure 1] to 3.3 mm [females; Figure 2]). Colouration ranges from pale (almost translucent) yellow to dark brown with the abdomen darker than the carapace; most specimens are pale. Y-shaped mid-carapace groove makes the eye region appear somewhat elevated. Clypeus (between the jaws and eyes) projects strongly forward. Abdomen dorsally with lightly contrasting pattern of dark "heart mark" (central elongated dark mark anteriorly on abdomen) bracketed by several pairs of darkened spots laterally against a paler background. Abdominal pattern may be indistinct or absent. Further morphological details are provided in Gertsch and Ivie (1936), Huber (2000), and Slowik (2009).

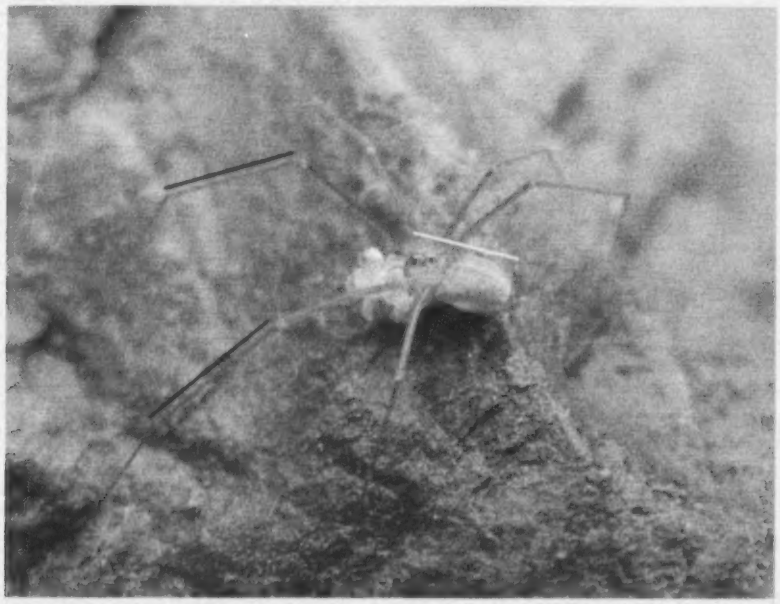

Figure 2. Female with pale abdomen and carrying an egg sac. White and black lines indicate approximate lengths of body and first leg tibiae respectively. Female photographed as found clinging to the undersides of rocks. Length, exclusive of legs, is approximately 3.3 mm. Photograph Darren Copley.

Two native pholcids occur in Canada. *Pholcophora americana* is common and widespread in the southern interior of British Columbia (BC) and a small portion of southern Alberta (AB). *Psilochorus hesperus* occurs only in south central BC (see Distribution). A third non-native pholcid, *Pholcus phalangioides* (Fuesslin), ranges throughout southern BC within anthropogenic structures and buildings. The morphological characters separating these three species are clear. *Psilochorus hesperus* can be distinguished from other cellar spiders in this genus by its distribution. It is the only species occurring north of central Oregon in western North America (Figure 4).

Population Spatial Structure and Variability

No population structure or genetic studies have been conducted on *P. hesperus*. There is good potential for the species to exist in discrete, genetically distinct populations (e.g., see Keith and Hedin 2012).

Designatable Units

Psilochorus hesperus is being assessed as one designatable unit, in the absence of information on discreteness or evolutionary significance among populations. The species occurs within the COSEWIC (2011) Southern Mountain Ecological Area.

Special Significance

Pholcidae is a large family of spiders (1300+ species) (Platnick 2012) characterized by a high degree of habitat specialization. The majority of species have restricted ranges (*e.g.*, Huber 2000, 2001, 2011b; Slowik 2009) within cooler and humid tropical climates.

Psilochorus hesperus is one of two native pholcids in Canada. The majority of the species' global range is within the Great Basin (Slowik 2009), a hot and dry ecosystem that extends through west-central North America, the northernmost extent within the Western Interior Basin of BC. The species is adapted to cool, humid microhabitats provided by the undersurface of large rocks within an otherwise hot, dry environment.

The range of *P. hesperus* within the Okanagan and Similkameen areas of BC overlaps with at least 204 additional species at risk (British Columbia Conservation Data Centre 2013), of which at least 65 have been assessed by COSEWIC (COSEWIC 2013).

The species is not known to have cultural significance to First Nations in the region (Jones pers. comm. 2012).

DISTRIBUTION

Global Distribution

The global range of *Psilochorus hesperus* is primarily within North America's hot, dry Great Basin, and stretches from extreme southcentral BC through central Washington (WA) to eastern California and southwestern Idaho (Figure 3) (Slowik 2009). The species is recorded through the arid interior of WA east of the Cascade Range, and narrows in the north to a single drainage, the Okanogan River Valley (Okanogan County, WA). At Oroville the distribution follows both the Similkameen and Okanagan River drainages north into BC. The approximate global range extent is less than 700 000 km^2.

Figure 3. Global range of *Psilochorus hesperus*. Sites within the United States are approximated from the distribution map in Slowik (2009).

Canadian Distribution

In Canada, *P. hesperus* is at the northern edge of its range in south-central BC (Slowik 2009). The species is recorded from 17 sites (sixteen extant and one presumed extirpated; Table 2) within lower elevations (280 – 760 metres elevation above sea level [asl]) of the Similkameen and Okanagan valleys (Figure 4). Less than 5% of the species' global range occurs in Canada.

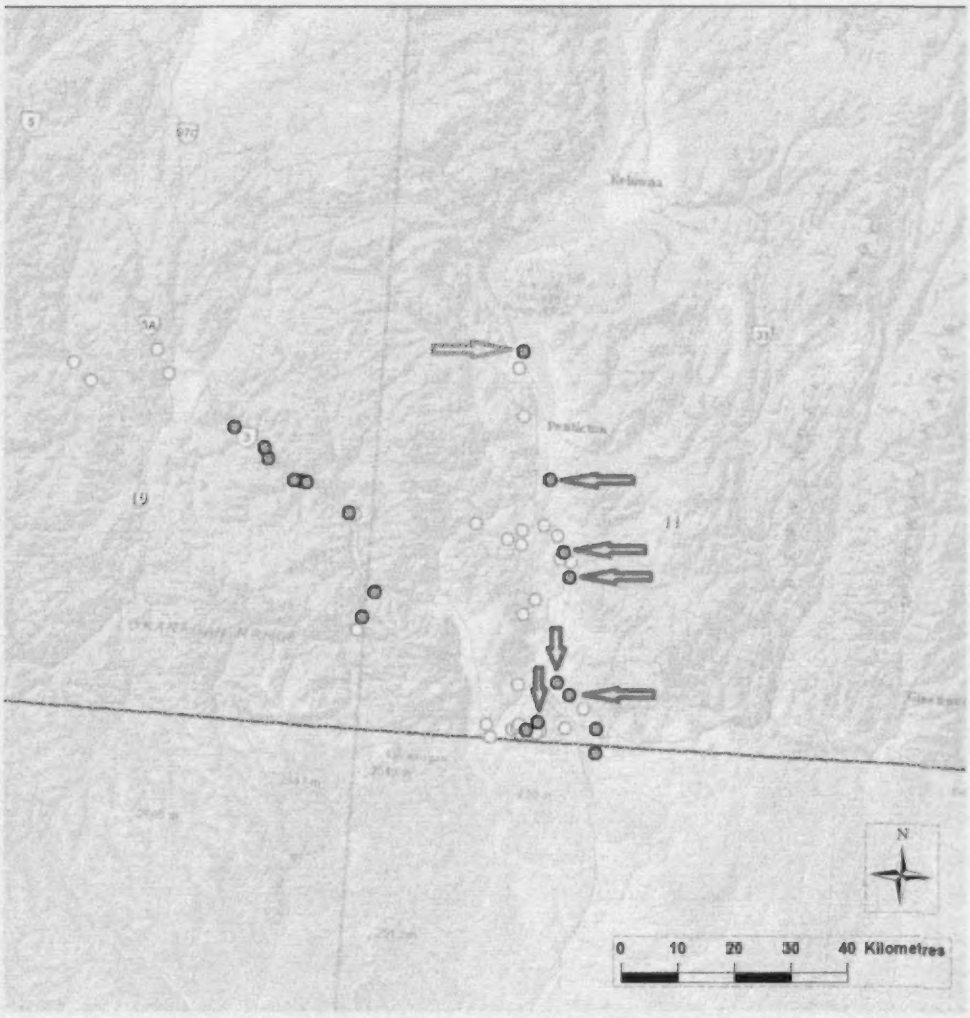

Figure 4. Canadian range of *Psilochorus hesperus*. Dark circles = all known sites; pale circles = searched sites. Green arrow = cemetery site at Summerland. Red arrows = Okanagan Valley sites with recent surveys (listed from north to south): east shore Skaha Lake (present 1996, undetected 2012), McIntyre Rd. (undetected 2001-2011, present 2012), Kennedy Flats (present 1995, undetected 2009), Haynes Lease/"The Throne" (present 1992 (Haynes Lease), 2001 and 2009 ("The Throne"), undetected 2012), Osoyoos Indian Reserve 1 (present 1995, converted to vineyards later that decade), and Kilpoola Lake (present 2007, undetected 2012).

In the Similkameen Valley (Figure 4, Table 2), *P. hesperus* is recorded from eight sites within a 75 km corridor of the Similkameen River from the vicinity of the Hayes Creek drainage (~10 km east of Princeton, site 2) to the international boundary in the South Okanagan Grasslands Protected Area East Chopaka (site 5).

In the Okanagan Valley (Figure 4), the species is recorded at nine sites from Summerland (site 12, northernmost site) to Osoyoos (site 11, southernmost site). The Summerland site is within a cemetery and may be an outlier (see Special Significance and Dispersal and Migration).

The Similkameen and Okanagan valley sites may represent disjunct populations. These drainages are tributaries of the Columbia River system and join approximately 12 km south of the international border at Oroville, WA. The spider has been recorded in WA near Oroville (Table 2) and sites approximately 30 km southward to the Columbia River Valley (see Figure 3).

Extent of Occurrence and Area of Occupancy

Based on all records (17 sites) the extent of occurrence (EO) in Canada is 2376 km^2 (Filion pers. comm. 2012). If the cemetery site (site 12 Summerland) and a site now presumed extirpated from agricultural development (site 11 Osoyoos Indian Reserve 1) are excluded the EO is reduced to 1429 km^2.

The index of area of occupancy (IAO), based on a 2 X 2 km grid for all 17 sites, is 68 km^2 (Filion pers. comm. 2012). Excluding the presumed extirpated site the IAO is 64 km^2. The IAO is likely an underestimate; there are potential sites on the east side of the Okanagan Valley between Oliver and Osoyoos and in the Similkameen Valley, particularly on First Nations land between Hedley and the international border. Using Google Earth imagery (Google Inc. 2011), and "rock/talus/sandbar" mapping in Vegetation and Habitat Types in Public Utility District No. 1 of Okanogan County (2009), an estimated 2 km^2 of potentially suitable specific rock habitat is available (Bennett pers. comm. 2012).

Search Effort

Targeted spider sampling (in general) began in the 1970s. Pholcid spiders were unrecorded in BC before the 1980s (see West *et al.* 1984, 1988). From 2001 to 2012 Pholcid surveys across southern BC (Table 3; Figure 5) targeted habitats known to have *P. hesperus*, including grasslands, open Douglas-fir (*Pseudotsuga menziesii*) and Ponderosa Pine (*Pinus ponderosa*) woodlands, and rocky areas in relatively xeric landscapes (Table 1). Most survey sites involved hiking within suitable habitats or were adjacent to or within a few hundred metres of roadways.

Table 1. General data on xeric areas of British Columbia surveyed for pholcid spiders 2001-2012. All surveys conducted by R.G. Bennett *et al.* *Pholcophora americana* was broadly distributed through most of the surveyed area; *Psilochorus hesperus* was restricted to the Similkameen River and parts of the southern Okanagan Valley. See Figure 5 for additional survey sites in BC.

Drainage	Waterway	General Area Surveyed
Fraser/ Thompson		
	Fraser River	Lytton to Williams Lake including some minor tributaries
	Thompson River	Lytton to Cache Ck., Kamloops, and Salmon Arm, incl some minor tributaries
	Nicola River	Spences Bridge to Stump and Douglas Lks.
	Chilcotin River	Riske Ck./Beecher Prairie to Farwell Canyon
	Seton River	Anderson Lake to Mission Ridge
	Bridge River	Carpenter Lake dam to Lillooet
	Yalakom River	Ore Ck. to Moha
Similkameen		
	Similkameen River	Whipsaw Ck. to Chopaka
	Tulameen River	Otter Lake/Tulameen to Princeton
	Allison Creek	7 Mile to Princeton
	Ashnola River	Buckhorn Rec. Site to Similkameen River
Okanagan Valley		
	Okanagan River	Numerous sites from Armstrong to Osoyoos
Kettle		
	Kettle River	Christian Valley to Rock Ck. and Grand Forks to Christina Lake
	Granby River	Volcanic Ck. to Grand Forks
Columbia/ Kootenay		
	Columbia River	Trail to Waneta
	Kootenay River	Whiteswan Lake/Canal Flats to Lake Koocanusa/Grasmere; Grohman Narrows (Nelson); including various tributaries

Canada's native pholcids are small, inconspicuous spiders that move quickly and therefore require focused search effort and specific sampling techniques. *Psilochorus hesperus* surveys are done through a combination of hand-collection (physical examination of habitat) and pitfall trapping. Hand-collection is the best method for determining pholcid presence and is the primary method in pholcid surveys (Bennett unpubl. data). Pitfall trapping is a passive method that involves burying a cup flush with the ground, filling the cup with preservative and leaving the cup for up to a month in order to record arthropod presence. This method is effective for long-term pholcid monitoring and detection of unrecorded populations.

More than 195 hours of hand searching for *P. hesperus* has accumulated in the past fifteen years, most of this search effort within the past few years by one to three spider specialists who specifically targeted habitats for this species. Pitfall trapping in suitable habitats (within at least 12 sites) spanning at least three field seasons (1991, 1994 and 1995) has also revealed some results (Table 2 and 3).

Table 2. *Psilochorus hesperus* records in southern British Columbia with 2012 search effort. Abbreviations: CDD – C.D. Dondale; GGES – G.G.E. Scudder; LR – L. Ramsay; RGB – R.G. Bennett; WDC – W.D. Charles. Latitude, longitude, and elevation data from Google Earth 6.1 (Google Inc. 2011). All specimens deposited in the Royal British Columbia Museum (Victoria, BC) except for collections by WDC and GGES identified by CDD which are in the Canadian National Collection of Insects and Arachnids (Ottawa, Ontario).

Site #	Year	Coll. Date	2012 Survey	Site	Owner ship	Elevation (m)	Habitat	Collector (C) and Identifier (ID)	Search Effort (Hours)
1	2001	26.ix. 2001	Not surveyed	CAN: BC: East of Hedley, near small stream crossing south end of Hedley / Nickelplate Road	Unknown	540	underside of rocks, open Ponderosa Pine, lots of *Latrodectus*	RGB	1
2	2008	1.v. 2008	Positive	CAN: BC: East of Princeton, Bromley Rock, Old Hedley Road, ~8km West of highway bridge	BC Crown; Park	571	underside of rocks in loose pile, roadside, open D-fir woods	RGB	1
	2012	17.vii. 2012	Positive	CAN: BC: East of Princeton, Bromley Rock, Old Hedley Road, ~8km West of intersection w highway 3	BC Crown; Park	571	underside of rocks in loose pile, roadside, open D-fir woods, south-facing shaded by firs and shrubberies	CC, DC, RGB	3
3	2012	17.vii.20 12	Positive	CAN: BC: East of Princeton, Old Hedley Road, ~ 12.5 km east of junction with highway 5A	Likely BC Crown (MoTH)	600	underside of rocks, at base of stabilized talus slope along access road, open D-fir woods, southwest-facing shaded by firs and tall grasses	CC, DC, RGB	3
4	2010	20.vii.20 10	Positive	CAN: BC: East of Princeton, Old Hedley Road, ~ 2 km NW of Bromley Rock, access road @ intersection of gas and hydro lines	Likely BC Crown (MoTH)	580	underside of rocks	RGB, CC, DC (C) RGB (ID)	3
	2012	17.vii.20 12	Positive	CAN: BC: East of Princeton, Old Hedley Road, ~ 2 km NW of Bromley Rock, access road @ intersection of gas and hydro lines	Likely BC Crown (MoTH)	580	underside of rocks, at base of stabilized talus slope along access road, open D-fir woods, south-facing shaded by firs and shrubberies	CC, DC, RGB	3

Site #	Year	Coll. Date	2012 Survey	Site	Owner ship	Elevation (m)	Habitat	Collector (C) and Identifier (ID)	Search Effort (Hours)
5	2008	3.v.2008	Positive	CAN: BC: East Chopaka, South Okanagan Grasslands Protected Area, ~2 km southwest of Kilpoola Lake	BC Crown; Park	890	underside of rocks, rocky outcrop, east-facing slope	RGB	1
	2012	17.vii.2012	Positive	CAN: BC: East Chopaka, South Okanagan Grasslands Protected Area, ~2 km southwest of Kilpoola Lake	BC Crown; park	890	underside of rocks, rocky outcrop, east-facing slope (west-facing slope on opposite side of this ridge did not have *P. hesperus*)	CC, DC, RGB	3
6	1996	8.viii. 1996	Not detected	CAN: BC: East shore Skaha Lake, ~ 4.5 km south of Penticton	Unknown; Very close to Nature Trust property	346	pitfalls in antelope brush	GGES (C) RGB (ID)	unknown
7	2007	31.v. 2007	Not detected	CAN: BC: North shore of Kilpoola Lake, West of Osoyoos, near road access	Likely BC Crown	821	underside of rocks in pile, open area	RGB	3
8	1992	9.iv-8.ix.1995	Not surveyed in 2012; not detected in 2009	CAN: BC: near Oliver, Kennedy Flats / McIntyre Canyon	Unknown	340-450	pitfalls in antelope brush, several sites centred on area of stated lat/long	GGES (C) RGB (ID)	unknown
9	2001	28.ix. 2001	Not detected	CAN: BC: off Road 22, Haynes Lease, rock face of "The Throne", South of Oliver	BC Crown; Ecological Reserve	390	underside of rocks, southerly open exposure	RGB	2
	2009	23.vi. 2009	Not detected	CAN: BC: off Rd 22, Haynes Lease, rock face of "The Throne", S of Oliver	BC Crown; Ecological Reserve	390	underside of rocks, southerly open exposure	RGB	2
	1992	8.viii-9.ix. 1992	Not detected	CAN: BC: Oliver, Haynes Lease	BC Crown; Ecological Reserve	360	pitfall in antelope brush/cactus	GGES (C) CDD (ID)	unknown
10	1992	7.ix-4.x. 1992	Not surveyed	CAN: BC: Osoyoos, East Bench	Private?	393	pitfall in antelope brush by irrigation line in mixed agricultural/residential area	GGES (C) CDD (ID)	unknown
11	1995	7.vii-3.x. 1995	Site now agricultural	CAN: BC: Osoyoos, Osoyoos Indian Reserve 1	Federal; Indian Reserve	350	pitfalls in antelope brush, several sites centred on area of stated lat/long	GGES (C) RGB (ID)	unknown
12	1982	10.viii.1982	Positive	CAN: BC: Summerland, Peach Orchard cemetery	Private	372	pitfall in sagebrush above graveyard	WDC (C) RGB (ID)	unknown
	2012	16.vii.2012	Positive	CAN: BC: Summerland, Peach Orchard cemetery	Private	372	underside of concrete landscaping blocks	CC, DC, RGB	3

Site #	Year	Coll. Date	2012 Survey	Site	Owner ship	Elevation (m)	Habitat	Collector (C) and Identifier (ID)	Search Effort (Hours)
13	2012	16.vii.2012	Positive	CAN: BC: Vaseux Lake, McIntyre Road, talus ~ 0.2 km east of highway	Unknown; may be within a protected area	376	underside of rocks, southwest-facing scree, shaded by dense saskatoons (*Amelanchier alnifolia*). Site surveyed many times 2001-2011 with negative results for *P. hesperus*.	CC, DC, RGB	3
14	2012	17.vii.2012	Positive	CAN: BC: W of Hedley, Old Hedley Road, ~1 km West of intersection with highway 3	BC Crown (MoTH)	548	underside of rocks, s of powerline right of way, open D-fir woods, shaded, south-facing slope	CC, DC, RGB	3
15	2005	30.viii.2005	Positive	CAN: BC: W of Hedley, Old Hedley Road, ~2 km W of intersection with highway 3	BC Crown (MoTH)	549	underside of rocks, s of powerline right of way, open D-fir woods	RGB	2
16	2006	29.v.2006	positive	CAN: BC: W of Hedley, Old Hedley Road, 3.2 km W of highway bridge	BC Crown (MoTH)	552	underside of rocks, s of powerline right of way, open D-fir woods	RGB, LR (C) RGB (ID)	2
	2012	17.vii.2012	Positive	CAN: BC: W of Hedley, Old Hedley Road, Forest Service Rec. Site, ~3.2 km West of intersection with highway 3	BC Crown	552	underside of rocks, s of powerline right of way, open D-fir woods	CC, DC, RGB	3
17	2012	17.vii.2012	Positive	CAN: BC: w of Keremeos, Ashnola River Rd, east-facing slope, west bank of river above gorge, ~1.7 km above first bridge	BC Crown (MoTH)	571	underside of rocks, open Douglas-fir habitat, shaded, east-facing exposure	CC, DC, RGB	3
	2012	17.vii.2012	Positive	CAN: BC: w of Keremeos, Ashnola River Rd, west-facing slope, east bank of river near mouth	BC Crown (MoTH)	469	underside of rocks, shaded, west-facing exposure	CC, DC, RGB	3
Not applicable.	1995	7.vii-10.ix.1995	not checked	USA: WA: Oroville, just south of international boundary	Not applicable	360	pitfalls, unknown habitat	GGES (C) RGB (ID)	unknown

Table 3. Search effort within *P. hesperus* habitat where no specimens were found during targeted surveys. Abbreviations: CC – C. Copley; DC – D. Copley; MF – M. Fairbarns; RGB – R.G. Bennett. Latitude, longitude, and elevation data from Google Earth 6.1 (Google Inc. 2011). Voucher specimens of other species collected at these sites are deposited in the Royal British Columbia Museum, Victoria, BC

Date Range	Site Searched	Elevation (m)	Remarks	Surveyors	Search Effort (hours)
2001-2011	CAN: BC: vicinity White Lake, Fairview/White Lake Road	~ 540	Many collections from underside of rocks and other suitable habitat,	RGB *et al.*	12
1994 - 2011	CAN: BC: White Lake Ranch	630	Undersides of rock, wood, and ranch debris	RGB	1
1994 - 2011	CAN: BC: Highway 3A, South shore Yellow Lake	800	Undersides of rock and wood	RGB	4
1994 - 2011	CAN: BC: White Lake Rd shale beds, north of radio telescope site	572	Undersides of rock	RGB	1
1994 - 2011	CAN: BC: vicinity Mahoney Lake, Green Lake Road	475	Undersides of rock and wood	RGB	3
1994 - 2011	CAN: BC: vicinity Okanagan Falls Provincial Park	~ 340	Undersides of rock and wood	RGB	2
1994 - 2011	CAN: BC: along west shore Vaseux Lake	340	Undersides of rock and wood	RGB	3
2001-2011	CAN: BC: Vaseux Lake, McIntyre Road, talus ~ 0.2 km East of Highway	~350-390	Many collections from underside of rocks and wood, (site produced *P. hesperus* in 2012 – see Table 2)	RGB	9
1994 - 2011	CAN: BC: near Oliver, Kennedy Flats / McIntyre Canyon	450	Undersides of rock and wood	RGB	3
1994 - 2011	CAN: BC: nr Vaseux Lake, various sites along McIntyre Ck. Road	~ 360-500	Undersides of rock and wood	RGB *et al.*	12
1994 - 2011	CAN: BC: Oliver, vicinity of UBC geology field camp	~ 480	Undersides of rock and wood	RGB *et al.*	3
1994 - 2011	CAN: BC: Osoyoos, var. locations along east side Osoyoos Lake ("Nk'Mip Pocket Desert")	~ 340	Undersides of rock and wood	RGB *et al.*	6
1994 - 2011	CAN: BC: Osoyoos, locations along e slope of Mt Kruger above golf course	~ 360-470	Undersides of rock, wood, rotting cow	RGB, MF	3
1994 - 2011	CAN: BC: Osoyoos, Richter Pass to Mt. Kobau summit	~ 660-1800	Undersides of rock and wood. (Also Blades and Maier 1996 study.)	RGB, MF	6
1994 - 2011	CAN: BC: nr SE shore of Kilpoola Lake, W of Osoyoos, nr road access	830	Undersides of rock and wood	RGB	1
1994 - 2011	CAN: BC: ~1.1 km S of Kilpoola Lake, disturbed grazed area, nr road access	800	Undersides of rock and wood	RGB	1
1994 - 2011	CAN: BC: ~1.3 km S of Kilpoola Lake, ridge top, west of road	990	Undersides of rock and wood	RGB, MF	4
1994 - 2011	CAN: BC: East Chopaka Protected Area, ~3.5 km SW of Kilpoola Lake	940	Undersides of rock	RGB	1
1994 - 2011	CAN: BC: East Chopaka Protected Area, ~4.5 km W of Kilpoola Lake	1000	Undersides of rock	RGB	1
1994 - 2011	CAN: BC: East Chopaka Protected Area, ~3.6 km W of Kilpoola Lake, at abandoned homestead	940	Undersides of wood and homestead debris	RGB	1
1994 - 2011	CAN: BC: East Chopaka Protected Area, ~3.6 km W of Kilpoola Lake, just w of abandoned homestead	950	Undersides of rock	RGB	1

Date Range	Site Searched	Elevation (m)	Remarks	Surveyors	Search Effort (hours)
1994 - 2011	CAN: BC: East Chopaka Protected Area, ~3.4 km W of Kilpoola Lake	970	Undersides of rock and wood, disturbed area (logging debris and cattle grazing)	RGB	1
1994 - 2011	CAN: BC: Chopaka, Highway 3 @ Chopaka/Nighthawk Rd, west of rd	470	Undersides of wood, debris in heavily grazed area	RGB, MF	2
1994 - 2011	CAN: BC: just NW of Chopaka/Nighthawk border crossing	460	Undersides of rock and wood in shallow ravines	RGB, MF	3
1994 - 2011	CAN: BC: Cawston, var locations along Old Fairview Rd / Blind Ck.	~ 490- 900	Undersides of rock and wood	RGB *et al.*	8
1994 - 2011	CAN: BC: Hedley, Hedley/Nickelplate Rd, top of slide above 1st set of switchbacks	980	Undersides of rock, wood, and debris	RGB, CC, DC	3
1994 - 2011	CAN: BC: nr. Keremeos, various sites along Ashnola River Valley	~ 700-1000	Undersides of rock, wood, and debris	RGB *et al.*	18
1994 - 2011	CAN: BC: Princeton, ~ 14 km north on Highway 5a	760	Undersides of rock	RGB, CC, DC	3
1994 - 2011	CAN: BC: Princeton, ~ 9 km north on Highway 5a @ Summers Ck. Road	725	Undersides of rock and wood	RGB, CC, DC	3
1994 - 2011	CAN: BC: Tulameen, south entry to town along Trans-Canada trail	780	Undersides of rock and wood	RGB	1
1994 - 2011	CAN: BC: Coalmont, n side of town along Trans-Canada trail	750	Undersides of rock and wood	RGB	1
16.vii. 2012	CAN: BC: Summerland, Giants Head Peak	820	Searched underside of rocks and wood, north and south-facing slopes near peak, open Douglas-fir, shaded	C. Copley, D. Copley, and R.G. Bennett	3
16.vii. 2012	CAN: BC: Penticton, Madeline/Max Lake	500	Searched underside of rocks, wood and debris, east-facing slope at edge of overgrown field, open Douglas-fir, shaded	C. Copley, D. Copley, and R.G. Bennett	3
16.vii. 2012	CAN: BC: east shore Skaha Lake, ~ 4.5 km s of Penticton, Nature Trust property at roadside pond	346	Searched underside of rocks, wood and debris, west and northwest-facing slopes south of pond, open Douglas-fir, disturbed site	C. Copley, D. Copley, and R.G. Bennett	3
16.vii. 2012	CAN: BC: Okanagan Falls, Allendale Rd, n of Blue Mtn Vineyards	446	Searched underside of rocks and wood, west-facing slopes , open Douglas-fir, shaded	C. Copley, D. Copley, and R.G. Bennett	3
17/vii. 2012	CAN: BC: off Rd 22, Haynes Lease, rock face of "The Throne", S of Oliver	390	Underside of rocks, southerly open exposure (*P. hesperus* records in previous years)	C. Copley, D. Copley, and R.G. Bennett	2
17.vii. 2012	CAN: BC: Oliver, Haynes Lease	360	Searched underside of wood and other debris, cactus field to w of Throne (*P. hesperus* records in previous years)	C. Copley, D. Copley, and R.G. Bennett	1
17.vii. 2012	CAN: BC: N shore of Kilpoola Lake, W of Osoyoos, nr road access	82	Underside of rocks in pile, open area (*P. hesperus* records in previous years)	C. Copley, D. Copley, and R.G. Bennett	3
17.vii. 2012	CAN: BC: East Chopaka Protected Area, ~2 km SW of Kilpoola Lake	890	Underside of rocks, rock outcrop, west-facing slope (east-facing slope on opposite side of this ridge supports *P. hesperus*)	C. Copley, D. Copley, and R.G. Bennett	3
				Total Hours	**147**

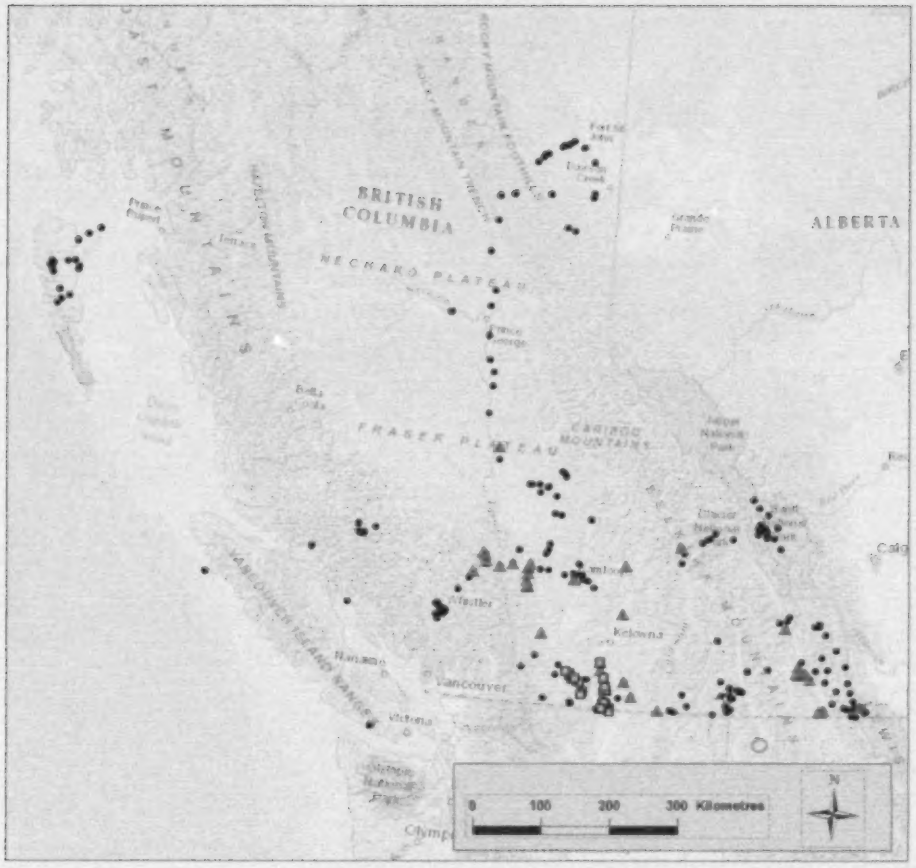

Figure 5. Map of British Columbia showing all *Psilochorus hesperus* records (orange squares); all records of related native cellar spider *Pholocophora americana* in BC (blue triangles; many of these dots also represent a minimum of 1.5 hours search effort) and general spider surveys in British Columbia from 2006 – 2013 (black dots; each dot represents at least 1.5 hours search effort per site). Map created by Alain Filion.

Table 4. *Psilochorus hesperus* summary of IUCN-CMP Threats applicable to each site.

Site Number	Site Name	Land Ownership	1.1	2.1	3.2	4.1	4.2	7.1	8.2	9.3	10.3	11.3
		Total Sites	**4**	**1**	**9**	**11**	**8**	**17**	**17**	**3**	**6**	**17**
1	CAN: BC: East of Hedley, near small stream crossing south end of Hedley / Nickelplate Road	Unknown	-	-	x?	x	x	x	x	-	x	x
2	CAN: BC: East of Princeton, Bromley Rock, Old Hedley Road, ~8km West of highway bridge	BC Crown	-	-	x?	x	x	x	x	-	x	x
3	CAN: BC: East of Princeton, Old Hedley Road, ~ 12.5 km east of junction with highway 5A	Likely BC Crown (Ministry of Transportation)	-	-	x?	x	x	x	x	-	x	x
4	CAN: BC: East of Princeton, Old Hedley Road, ~ 2 km NW of Bromley Rock, access road @ intersection of gas and hydro lines	Likely BC Crown (Ministry of Transportation)	-	-	x?	x	x	x	x	-	-	x

Site Number	Site Name	Land Ownership	1.1	2.1	3.2	4.1	4.2	7.1	8.2	9.3	10.3	11.3
		Total Sites	4	1	9	11	8	17	17	3	6	17
5	CAN: BC: East Chopaka, South Okanagan Grasslands Protected Area, ~2 km southwest of Kilpoola Lake	BC Crown	-	-	-	-	-	x	x	-	-	x
6	CAN: BC: East shore Skaha Lake, ~ 4.5 km south of Penticton	Unknown; close proximity to The Nature Trust private conservation property	x	-	-	x	-	x	x	-	-	x
7	CAN: BC: North shore of Kilpoola Lake, West of Osoyoos, near road access	Likely BC Crown	-	-	-	-	-	x	x	-	-	x
8	CAN: BC: near Oliver, Kennedy Flats / McIntyre Canyon	Unknown	-	-	-	x	-	x	x	-	-	x
9	CAN: BC: off Road 22, Haynes Lease, rock face of "The Throne", South of Oliver	BC Crown Ecological Reserve	-	-	-	-	-	x	x	x	-	x
10	CAN: BC: Osoyoos, East Bench	Private?	x	-	-	-	-	x	x	x	-	x
11	CAN: BC: Osoyoos, Osoyoos Indian Reserve 1	Federal; Indian Reserve	x?	x?	-	-	-	x?	x?	x?	-	x?
12	CAN: BC: Summerland, Peach Orchard cemetery	Private	x	-	-	-	-	x	x	-	x	x
13	CAN: BC: Vaseux Lake, McIntyre Road, talus ~ 0.2 km east of highway	Unknown; may be within protected area	-	-	x?	x	-	x	x	-	x	x
14	CAN: BC: W of Hedley, Old Hedley Road, ~1 km West of intersection with highway 3	BC Crown	-	-	x?	x	x	x	x	-	x	x
15	CAN: BC: W of Hedley, Old Hedley Road, ~2 km W of intersection with highway 3	BC Crown	-	-	x?	x	x	x	x	-	x	x
16	CAN: BC: W of Hedley, Old Hedley Road, Forest Service Rec. Site, ~3.2 km West of intersection with highway 3	BC Crown	-	-	x?	x	x	x	x	-	x	x
17	CAN: BC: w of Keremeos, Ashnola River Rd, west-facing slope, east bank of river near mouth	BC Crown	-	-	x?	x	x	x	x	-	x	x

Surveys confirm *P. hesperus* is restricted to rocky habitats in a narrow low-elevation band along the Similkameen Valley and at scattered sites in the southern Okanagan Valley (Figure 5). Surveys have been done in urban environments in the region and the species has not been recorded in cellars or human-made structures within urban areas historically, or in recent, dedicated surveys.

To date surveys in the lower Similkameen Valley have focused on the northeastern side of the valley, including the Ashnola Valley. The distribution of *P. hesperus* is not known in the First Nations lands (Lower Similkameen Indian Band) on the southwestern side of the valley (more than 17,000 ha from Hedley to Keremeos to Cawston and the international border [Statistics Canada 2012a]). However, suitable rock habitat may be widely separated south of the Cawston area (see "Other" habitat types, in Public Utility District No. 1 of Okanogan County [2009]).

Surveys in the Okanagan Valley have focused on known sites and habitats where permission to survey was obtained. Large portions of habitat on the east side of the valley (e.g., approximately 13 000 ha of First Nations land around Oliver, Osoyoos, and Osoyoos Lake areas [Statistics Canada 2012a]) may have potential habitat for *P. hesperus*, based on previous collection records (*e.g.*, Osoyoos Indian Reserve 1).

Loose talus habitats are considered unsuitable and the majority of rock habitat in the Okanagan and Similkameen Valleys that is talus does not appear suitable. The Similkameen Valley in WA has not been well surveyed (Crawford pers. comm. 2012). However there is also much unsuitable habitat, such as the alkali flats south of Chopaka/Nighthawk international border crossing, open sagebrush grassland and eroded silt slopes between the community of Nighthawk (international border) and Shanker's Bend (United States) (see Vegetation and Habitat Types in Public Utility District No. 1 of Okanogan County [2009]).

Conversely, the more common and broadly distributed *Pholcophora americana* is recorded widely in southern BC (Figure 5). Since 2006 there has been substantial search effort that has specifically targeted spiders throughout BC (Copley pers. comm. 2013) (Figure 5). Each dot shown in Figure 5 represents search effort of at least 1.5 hours per site since 2008.

HABITAT

Habitat Requirements

Psilochorus hesperus is associated with hot, dry and arid environments characteristic of the Great Basin ecosystem. In BC ecosystems are described as biogeoclimatic zones, a vegetative classification system developed by the BC Ministry of Forests (2009). *Psilochorus hesperus* habitat is within the Bunchgrass (sagebrush-steppe) and Ponderosa Pine (open parkland) biogeoclimatic zones of the Southern Interior Ecoprovince in the southernmost parts of the Similkameen and Okanagan valleys (Demarchi 2011; Figure 4). The species occupies xeric sites of the driest variant of the Bunchgrass zone (BGxh1 Very Hot Dry Bunchgrass) and margins of the Ponderosa Pine zone (PPxh1subzone Very Hot Dry Ponderosa Pine) (BC Ministry of Forests 2009).

Psilochorus hesperus is associated with specific rock undersurfaces that provide stable, cool and humid microclimatic conditions within an otherwise hot external environment (Figure 7 – 12 and 14) (Bennett unpubl. data; Crawford pers. comm. 2013). Spatially, rocky undersurfaces have open space for territorial and individual movement and are not flush with the underlying substrate (Bennett unpubl. data). Occupied rocks are stable and unlikely to be dislodged (*i.e.*, rocks in active talus slopes are unsuitable habitat). The dimensions of suitable rock habitat are difficult to generalize. However, individual females appear to require a territorial area of about 10-15 cm diameter (Bennett unpubl. data).

Rocks occupied by *P. hesperus* are typically protected from full-day sun exposure (Figure 6-9) (Bennett unpubl. data) provided by open forest cover dominated by Douglas-fir (*Pseudotsuga menziesii*), Ponderosa Pine [*Pinus ponderosa*]), shrubs such as Oceanspray (*Holodiscus discolor*) and other vegetation characteristic of these ecosystems. The spider is less commonly recorded from similar rocky areas within open bunch grass vegetation with no forest cover. In the absence of shading factors, rocks on north- and east-facing slopes will host *P. hesperus* while similar rocks on south- or west-facing slopes will be less likely to.

Figure 6. South Okanagan Grasslands Protected Area Chopaka East site, ~ 2 km southwest of Kilpoola Lake (west of Osoyoos), July 2012. This population was first recorded in 2008. Many of these rocks harbour *P. hesperus* with northeast exposure and shading from shrubs providing good environmental protection.

Figure 7. Suitable habitat for *Psilochorus hesperus* along Old Hedley Road just east of Hayes Creek, ~ 12.5 km east of the junction with Highway 5A near Princeton, July 2012. East view. Many rocks in this image harbour *P. hesperus*.

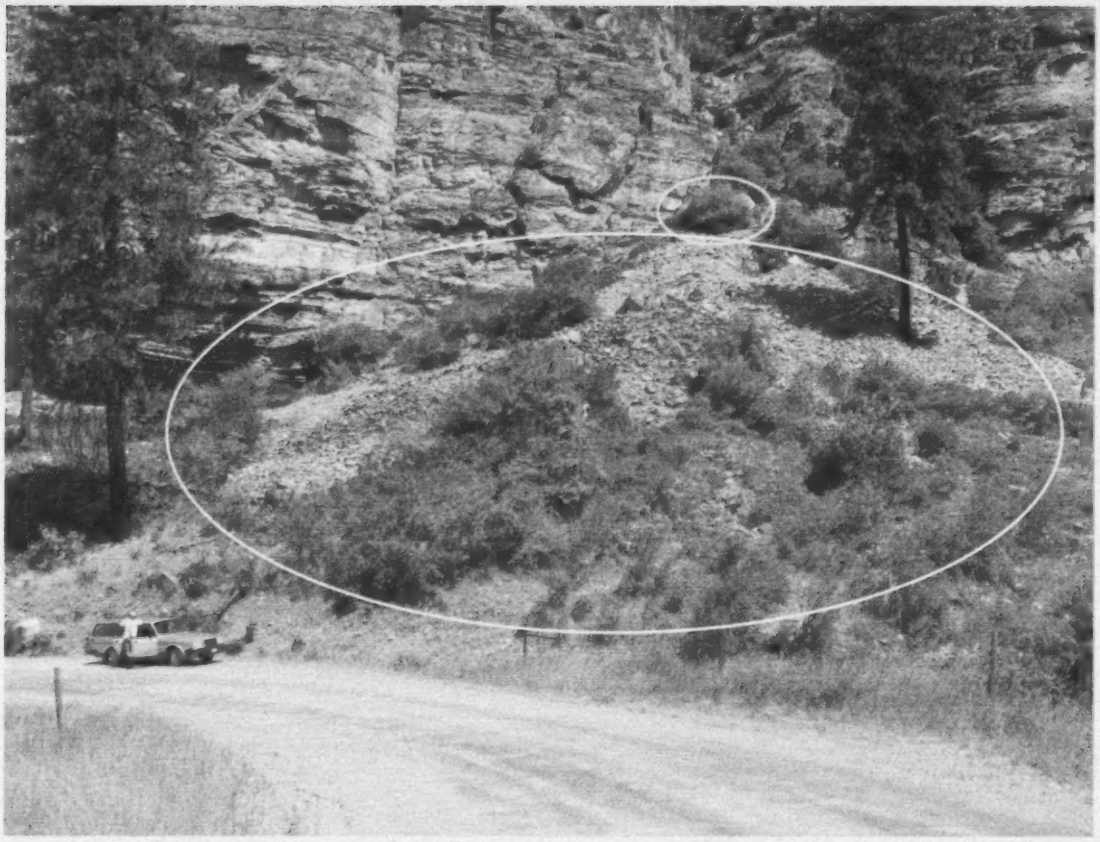

Figure 8. Suitable and unsuitable habitat for *P. hesperus* at the McIntyre Road bluffs immediately east of Vaseux Lake, July 2012. Rocky slope faces southwest. This site has been surveyed for pholcids and other spiders several times between 2001 and 2012. *Psilochorus hesperus* was first observed here in 2012 and only at one site (yellow oval) where rocks are afforded environmental protection by a dense thicket of Saskatoon Serviceberry. Other areas of this slope (white oval) contain unsuitable exposed habitat as well as a significant area of apparently suitable habitat shaded by shrubs and Ponderosa Pines; no *P. hesperus* have been found in those unsuitable or apparently suitable habitats. Presumably the very hot southwestern exposure makes this site and its rock habitats generally unsuitable for *P. hesperus*.

Figure 9. Artificial rock wall supporting *P. hesperus* in otherwise unsuitable habitat, Peach Orchard Cemetery, Summerland, July 2012. The cemetery is located on an exposed, hot, east-facing steep slope; adjacent habitat is primarily sagebrush (*Artemesia* sp.) on fine silt soil with no rock. At this site, specimens of *P. hesperus* occur only on the undersides of some of the capping slabs on the cement block retaining walls (other available interstitial spaces are packed with silt). This is the northernmost known site for *P. hesperus* and is more than 35 km north of the McIntyre Road bluffs, the nearest known occupied site. A single mature female (carrying an egg sac) and several juveniles were observed in 2012.

Psilochorus hesperus records from woody substrates are considered anomalous (Bennett unpubl. data; R. Crawford pers. comm. 2013).

Habitat Trends

Substantial historical habitat loss has been documented within the lower-elevation grassland ecosystems of the Okanagan and Similkameen valleys (see Lea 2008). The habitat trends within the range of *P. hesperus* that apply specifically to the rock habitat (for residence) and suitable wandering/dispersal habitat needed to link these rocky sites are difficult to quantify. The current and historic use of rocky outcrops and other rock habitats for road construction materials and other resource extraction purposes is not well documented for the Okanagan and Similkameen valleys.

However, some general habitat trends can be inferred. The majority of the Canadian range of *P. hesperus* overlaps with the Okanagan-Similkameen Regional District, which has a current human population of 81,000 that is projected to increase 34% to 108,000 by 2031 (Regional District of Okanagan-Similkameen 2012; Statistics Canada 2012b). With this human population increase comes the need for further urban, rural and agricultural development. Historic ecosystem mapping for some of the Antelope-brush bunchgrass ecosystems shows a 67.4% loss to development (Iverson 2012).

Agriculture is one of the major economic drivers in the range of *P. hesperus*. For example, the lower Similkameen and south Okanagan Valleys have the largest concentration of vineyards in Canada (Regional District of Okanagan-Similkameen 2012). Vineyard area (ha) in BC increased between 1989 (445 ha) and 2011 (3946 ha) by almost 900% (British Columbia Ministry of Agriculture, Food and Fisheries 2004; Lea 2008; Simms 2012). The majority of vineyard development has been in the south Okanagan and lower Similkameen Valleys (see Threats).

BIOLOGY

Information on *P. hesperus* is summarized from Huber (2005) and Slowik (2009) and from unpubl. data (Bennett pers. comm. 2012; Huber pers. comm. 2012; Slowik pers. comm. 2012).

Life Cycle and Reproduction

Pholcid life cycles are poorly understood. Collection and search effort data (see Table 2 and 3) suggest *P. hesperus* has a one-year life span, although adult females are generally present year-round. Adult females and juveniles overwinter; adult males and new adult females mature in early spring; adult males are unlikely to be encountered after late summer (Bennett unpubl. data; Slowik 2009).

Psilochorus spiders live in small webs composed of a few lines of silk (Bennett unpubl. data; Huber 2005; Slowik 2009). Mating has not been observed. As in most spider species, a mature male spins a small sperm web, deposits a drop of sperm and transfers it to the genital bulbs of his palpi prior to courtship of females and mating. Mated female pholcid spiders generally produce and guard a series of egg sacs over several months resulting in a series of juvenile age classes (Huber pers. comm. 2012). Female *P. hesperus* produce and guard one egg sac at a time and each sac is a loosely bound ball of up to about two dozen eggs carried in the mother's jaws.

Physiology and Adaptability

There is no information on the physiology or adaptability of *P. hesperus*. Artificial objects such as cement blocks (see Figure 9) may mimic microclimatic conditions and spatial territory requirements (e.g., site 12 Summerland site).

The general public as well as arachnologists regularly and routinely sample non-natural habitats throughout the world. While this search effort is not quantifiable, it is significant and assumed synanthropic records of *P. hesperus* would be recorded during such widespread searches. Within its Canadian range (as well as in the Okanogan Valley in WA) the only synanthropic record for the species is Peach Orchard Cemetery in Summerland (site 12). This population may be the result of passive anthropogenic dispersal via artificial substrate (concrete landscaping blocks, origin unknown). The cemetery is the northernmost *P. hesperus* site, surrounded by unsuitable habitat which has been searched (Copley pers. comm. 2013), and the nearest extant site is more than 35 km to the south.

Dispersal and Migration

Psilochorus hesperus is known to disperse short distances from occupied sites by wandering overland (Bennett unpubl. data). Pitfall trapping data (Site 6, 8, 9, 10 and 11, Table 2) suggest adult males, females and juveniles wander from rock substrates at night during the summer months. Dispersal is likely in response to crowding (which leads to cannibalism) and/or a lack of suitable prey; both of which are known behaviours for spiders (Duffey 1998; Foelix 2011). Mature males wander in search of receptive mature females (Foelix 2011).

Several species of pholcids, including at least one species of *Psilochorus*, are well-known synanthropes and easily dispersed by humans (Bennett unpubl. data; Huber 1994, 2005, pers. comm.; Slowik 2009, pers. comm.). *Psilochorus hesperus* may be dispersed passively through the transportation of rocks or artificial substrates (Bennett unpubl. data; J. Slowik pers. comm. 2013) (see Physiology and Adaptability). Synanthropic dispersal of *P. hesperus* is an unlikely occurrence in northern parts of its range, mainly because of widely separated areas of occupied habitat and overall small populations.

The ability of *P. hesperus* to recolonize large rocks within disturbed habitats has not been studied. Within BC, at least 10 of the 17 sites (59%) are adjacent to roadsides, suggesting the species may have an ability to slowly recolonize the undersurfaces of large suitable rocks within disturbed habitats, from adjacent natural habitats. In WA, *P. hesperus* has been recorded from under rocks within disturbed habitats such as roadside and railroad right-of-ways, at nine out of 82 collection sites (approximately 11% of sites). It is assumed the species colonized these disturbed habitats from adjacent natural habitats.

Aerial ballooning is a common dispersal mechanism in many spider families (Greenstone *et al.* 1987; Bennett unpubl. data 2003; Foelix 2011) but has not been observed nor is likely in pholcids (Huber pers. comm. 2012; Bennett unpubl. data).

Interspecific Interactions

Interspecific interactions for *P. hesperus* have not been well documented. *Psilochorus* spiders are often found in close association with the webs of other spiders (Gertsch 1979), especially cobweb weavers (Family Theridiidae), which may be common in the same rocky habitats. For example, Slowik (2009) documented *P. imitatus* living within the web of a species of *Steatoda*. *P. hesperus* has also been recorded living in the webs of Western Black Widows (*Latrodectus hesperus*) (R. Bennett (unpubl. data).

Psilochorus hesperus are generalist predators and consume insects and other spiders. Spider wasps (Hymenoptera: Pompilidae) are significant predators of spiders (Gertsch 1979; Foelix 2011). Other predators of spiders include insects, other spider species, frogs, birds and small mammals such as shrews. Fungal infections and nematodes often affect spiders (Gertsch 1979; Foelix 2011). Specimens of *P. hesperus* dispersing from the protection of their rock habitats at night are especially vulnerable to predation by bats and other nocturnal species.

POPULATION SIZES AND TRENDS

Sampling Effort and Methods

There are no studies on population sizes and trends. Targeted *P. hesperus* sampling to date (2012) has primarily been to record the species' presence and range in BC (Table 2).

Abundance

Abundance estimates are not possible to calculate based on existing data.

Fluctuations and Trends

Population fluctuation and trends are unknown. However, inferences from presence/not detected data (Table 2 and 3) are available. Sites in the Similkameen Valley have remained occupied between 2001 and 2012. However, populations at four sites in the Okanagan Valley were not detected in 2012: Site 7 Kilpoola Lake (present 2007, not recorded 2012); Site 9a Haynes Lease (present 1992, not recorded 2012); Site 9b Haynes Lease "The Throne" (present 2001 and 2009, not recorded 2012); Site 8 Kennedy Flats (present 1995, not recorded 2009); Site 6 East shore Skaha Lake (present 1996, not recorded 2012). Similarly Site 13 McIntyre Road (undetected 2001 – 2011) was not recorded until 2012. Known populations of *P. hesperus* in the Okanagan Valley are in open, exposed rocky habitats (e.g., Figure 6, 8) while those in the Similkameen are in rocky habitats with some vegetative protection (Figure 7). These factors may contribute to presence/not-detected records at Okanagan valley sites.

Rescue Effect

The Okanagan and Similkameen valleys span the US border and join at Oroville to become Okanogan Valley in WA. *Psilochorus hesperus* was caught by pitfall trapping in 1995, less than 1.5 km south of the international border (Table 2). The next nearest *P. hesperus* site in WA is 35 km south near Tonasket (Crawford unpubl. data) (see Distribution). Potential habitat in the Okanogan Valley from the international boundary south of Tonasket is agricultural (Google Inc. 2011). However, that corridor and its tributaries have not been well surveyed, especially in the US portions of the Similkameen Valley between Oroville and the international boundary. This area does contain a small amount of potential habitat that could provide important linkages between populations in the US (see Vegetation and Habitat Types in Public Utility District No. 1 of Okanogan County [2009]).

THREATS AND LIMITING FACTORS

Background

The International Union for Conservation of Nature-Conservation Measures Partnership (2006) (IUCN-CMP) threats calculator was used to classify and list threats to *P. hesperus* (Salafsky *et al.* 2008; Master *et al.* 2009). Results of the calculator suggest an overall low threat impact (Table 5). Threats applicable to *P. hesperus* are discussed below.

Table 5. IUCN-CMP (World Conservation Union–Conservation Measures Partnership) unified threats classification system. Threats may be observed, inferred, or projected to occur in the near term. Threat "impact" is calculated from scope and severity. For information on how the values are assigned, see Master *et al.* (2009) and for threat classification see CMP (2010).

Species Name: Northwestern Cellar Spider (*Psilochorus hesperus*)
Date: September 10, 2013; updated February 28, 2014
Assessed by: Jennifer Heron (Arthropods SSC Co-chair), Claudia Copley (Royal British Columbia Museum), Orville Dyer (BC Ministry of Forests, Lands and Natural Resource Operations), Dave Fraser (BC Ministry of Environment).

		Level 1 Threat Impact Counts		
	Threat Impact	**high range**	**low range**	
	Very High	0	0	
	High	0	0	
	Medium	0	0	
	Low	3	3	
	Calculated Overall Threat Impact:	Low	Low	

Threat		Impact (calculated)	Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
1	Residential & commercial development	Low	Small (1-10%)	Slight (1-10%)	High (Continuing)	Cumulative impacts of housing and industrial development surrounding the urban centres of Canada, specifically in southern regions approximately 200km from the US border.
1.1	Housing & urban areas	Low	Small (1-10%)	Slight (1-10%)	High (Continuing)	Some sites are within private land and there is potential for urban development. Areas around Skaha Lake, Osoyoos East bench and within Osoyoos Indian Reserve1 (although this site is presumed extirpated).
1.2	Commercial & industrial areas		Unknown	Unknown	Unknown	Applies to potential unchecked habitat. For example, a prison is being constructed in some open grassland habitat, between Oliver and Osoyoos on the east side of the Okanagan Valley. Other forms of commercial development, such as an industrial park (within the same area as the prison) are ongoing. Impacts to specific rocky habitats are unknown.
1.3	Tourism & recreation areas					Not applicable.
2	Agriculture & aquaculture	Low	Small (1-10%)	Extreme (71-100%)	High (Continuing)	
2.1	Annual & perennial non-timber crops	Low	Small (1-10%)	Extreme (71-100%)	High (Continuing)	Applies to potential unchecked habitat. Agricultural intensification in lower-elevation areas surrounding urban centres of Canada. Although this threat is historical, intensification of agricultural practices has occurred within these agricultural areas.
2.2	Wood & pulp plantations					Not applicable.
2.3	Livestock farming & ranching					Not applicable.
2.4	Marine & freshwater aquaculture					Not applicable.
3	Energy production & mining	Negligible	Negligible (<1%)	Moderate (11-30%)	Moderate (Possibly in the short term, < 10 yrs)	
3.1	Oil & gas drilling					Not applicable.
3.2	Mining & quarrying	Negligible	Negligible (<1%)	Moderate (11-30%)	Moderate (Possibly in the short term, < 10 yrs)	Possible minor gravel and road materials extraction from areas along roadways. This is likely to not impact the entire habitat polygon.
3.3	Renewable energy					Not applicable.
4	Transportation & service corridors	Low	Small (1-10%)	Slight (1-10%)	Moderate (Possibly in the short term, < 10 yrs)	
4.1	Roads & railroads	Low	Small (1-10%)	Slight (1-10%)	Moderate (Possibly in the short term, < 10 yrs)	Road maintenance and construction materials within rock areas adjacent to roadways. The threat has the potential to destroy a specific occupied habitat, although it is unlikely to destroy all rocky potentially occupied habitats along an entire stretch of roadway. Threat is large (11/16 sites) but severity was scored lower because the entire rocky habitat will not likely be impacted.

Threat		Impact (calculated)	Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
4.2	Utility & service lines	Low	Small (1-10%)	Slight (1-10%)	Moderate (Possibly in the short term, < 10 yrs)	Pipeline construction and maintenance can directly impact *P. hesperus* habitat, especially within the pipeline right-of-way. In some cases, vegetation and debris that has accumulated in the right-of-way could be deposited on the adjacent areas and impact dispersal and occupied sites. Where undisturbed *P. hesperus* habitat occurs adjacent to the pipeline and hydroelectric corridors, observational data suggest the species is able to disperse into and occupy suitable new habitat in the corridors following construction/maintenance disturbance events and once sufficient time has passed. For example, *P. hesperus* is recorded in stabilized rocks adjacent to pipeline and hydroelectric corridor access roads at two sites (site 1 and 2) along the Old Hedley Road. More study is required. This threat is likely to impact eight sites.
4.3	Shipping lanes					Not applicable.
4.4	Flight paths					Not applicable.
5	Biological resource use					Not applicable.
5.1	Hunting & collecting terrestrial animals					Not applicable.
5.2	Gathering terrestrial plants					Not applicable.
5.3	Logging & wood harvesting					Not applicable.
5.4	Fishing & harvesting aquatic resources					Not applicable.
6	Human intrusions & disturbance					
6.1	Recreational activities					Not applicable.
6.2	War, civil unrest & military exercises					Not applicable.
6.3	Work & other activities					Not applicable.
7	Natural system modifications	Not a Threat (in the assessed timeframe)	Small (1-10%)	Extreme (71-100%)	Low (Possibly in the long term, >10 yrs)	
7.1	Fire & fire suppression		Pervasive (71-100%)	Unknown	Moderate (Possibly in the short term, < 10 yrs)	Fires are possible within the species' range. Fires would impact the trees and shrubs shading occupied rocky areas, thus affecting the cooling affect these plants have on occupied rocky substrates and the microclimatic conditions needed for these spiders.
7.2	Dams & water management/use	Not a Threat (in the assessed timeframe)	Small (1-10%)	Extreme (71-100%)	Low (Possibly in the long term, >10 yrs)	Proposed dam sites within the lower Similkameen, in the US.

Threat		Impact (calculated)	Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
7.3	Other ecosystem modifications					Not applicable.
8	Invasive & other problematic species & genes		Pervasive (71-100%)	Unknown	High (Continuing)	
8.1	Invasive non-native /alien species		Pervasive (71-100%)	Unknown	High (Continuing)	There are likely invasive plants at all sites but the impact of invasive plants is unknown.
8.2	Problematic native species					Not applicable.
8.3	Introduced genetic material					Not applicable.
9	Pollution		Restricted (11-30%)	Unknown	High (Continuing)	
9.1	Household sewage & urban waste water					Not applicable.
9.2	Industrial & military effluents					Not applicable.
9.3	Agricultural & forestry effluents		Restricted (11-30%)	Unknown	High (Continuing)	Pesticide drift from adjacent agricultural areas into occupied sites is a potential threat. This threat applies to three sites.
9.4	Garbage & solid waste					Not applicable.
9.5	Air-borne pollutants					Not applicable.
9.6	Excess energy					Not applicable.
10	Geological events	Negligible	Restricted (11-30%)	Negligible (<1%)	Moderate (Possibly in the short term, < 10 yrs)	Over the short-term small landslides, debris, silting and slumping may cause the local extirpation of populations. Over the longer term, populations may be able to recolonize suitable rocks from areas in the habitat polygon that were not disturbed.
10.1	Volcanoes					Not applicable.
10.2	Earthquakes/tsunamis					Not applicable.
10.3	Avalanches/landslides	Negligible	Restricted (11-30%)	Negligible (<1%)	Moderate (Possibly in the short term, < 10 yrs)	Small landslides and slumping are possible at some sites. The type of debris that is in the landslide will determine the impact to the spider. If the debris is silt or clay, the landslide could fill or seep into the territorial spaces under occupied rocky sites. This threat is possible at six sites.
11	Climate change & severe weather					Not applicable.
11.1	Habitat shifting & alteration					Not applicable.
11.2	Droughts					Not applicable.
11.3	Temperature extremes		Unknown	Unknown	High (Continuing)	Temperature extremes at some sites, especially if areas are cleared or exposed from other threats (e.g., road construction, maintenance, wildfire, etc.).

Threat		Impact (calculated)	Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
11.4	Storms & flooding					Not applicable.

Residential and Commercial Development (Threat 1)

1.1 Housing and Urban Areas.

Population growth in the Okanagan-Similkameen Regional District from 2011-2031 is projected at more than 30% (Regional District of Okanagan-Similkameen 2012) (see Habitat Trends). The Regional Growth Strategy aims to protect sensitive habitats; however, this region has some of Canada's most desirable real estate and there is constant pressure to build (*e.g.*, see http://www.regalridge.com/). Although trend data are not available for specific rocky areas, residential development continues on open slopes (dispersal habitat) and rocky outcrops (nest habitat).

This threat applies to potential habitat. For example, unsurveyed rock habitat on the western slopes of Anarchist Mountain has been converted to residential development. Blasting and filling of rock outcrops occurred on the east side of Skaha Lake (Dyer pers. comm. 2013).

Agriculture and Aquaculture (Threat 2)

2.1 Annual and Perennial Non-Timber Crops.

Agricultural development (specifically vineyard development) has increased substantially from 1989 and 2011 (see Habitat Trends) (British Columbia Ministry of Agriculture, Food and Fisheries 2004; Lea 2008; Simms 2012). During this development, significant dispersal habitat for *P. hesperus* was also converted. For example, low elevation bunchgrass grasslands have decreased by about 70% since the 1800s (see Lea 2008) particularly along the east side of the Okanagan Valley from Vaseux Lake to Osoyoos (see Figures 8, 9 in Lea 2008). This area also corresponds to all recorded sites for *P. hesperus* in this valley. Valley bottom areas of the lower Similkameen Valley between Keremeos and the international boundary have also been converted to agricultural purposes (Google Earth 2011).

This threat applies to potential habitat. In the past, agricultural development eliminated site 11 (Osoyoos Indian Reserve 1).

Energy production and mining (Threat 3)

3.2 Mining and Quarrying.

Sites with proposed mining and gravel extraction within the range of *P. hesperus* are currently under review, and government staff are regularly asked to review potential applications for conservation values. Staff are most likely not aware of this species and the importance of conservation of rocky habitats for the species.

This threat applies to sites adjacent to roadways, where sites could be designated as a source of gravel, rock or road materials that are necessary for road maintenance in the area. This threat also applies to potential habitat.

Transportation and Service Corridors (Threat 4)

4.1 Roads and Railroads.

The major highways of the lower Similkameen Valley (Highway 3), Okanagan Valley around Skaha Lake, Vaseux Lake and McIntyre Bluffs (Highway 97) and at Osoyoos (Highway 3 and 97) are dispersal barriers for *P. hesperus*. Highway 3 traverses known or potential habitat from Princeton to the west side of Richter Pass and crosses the Okanagan Valley between the west side of Richter Pass on Mount Kobau to Anarchist Mountain. In the Okanagan Valley, particularly on the approaches to Anarchist Mountain west of Osoyoos, the highway traverses *P. hesperus* sites. Highway 97 at Skaha Lake/Vaseux Lake/McIntyre Bluffs for *P. hesperus* sites and potential habitat.

Highway maintenance and expansion may destroy roadside habitats. For example, about 6 km upstream from Hedley, *P. hesperus* occupies habitat immediately adjacent to the Similkameen River bridge. Replacement of this bridge and the associated rerouting of Highway 3 in the 1990s likely destroyed rocky habitat.

This threat applies to most sites adjacent to roadways or along transportation corridors (11 sites). At some sites, the occupied rock habitat is not likely suitable but adjacent dispersal and surveyed areas (where no specimens have been recorded) may be impacted in the future.

4.2 Utility and Service Lines.

Pipeline construction and maintenance can directly impact *P. hesperus* habitat. A natural gas pipeline crosses the Okanagan Valley at Manuel Flats/Oliver, enters the lower Similkameen Valley at Keremeos, and follows two routes north through the valley (Fortis BC 2011). One route crosses the mouth of the Ashnola Valley and travels overland via the Paul Creek drainage to rejoin the Similkameen Valley near Princeton. The other route follows the valley bottom on the northeast side to Princeton, parallel with Highway 3 and the Old Hedley Road. This route travels through all the Old Hedley Road sites occupied by *P. hesperus* (site 1, 2, 3, 4, 14, 15, 16). For example, the Oliver to Ashnola River/Paul Creek pathway is included in 161 km of pipeline upgrading scheduled to commence in late 2014 (FortisBC 2011). This will involve extensive excavation and other forms of significant habitat disruption in or adjacent to *P. hesperus* habitat, especially in the vicinity of the mouth of the Ashnola River (site 17). This threat is likely to impact eight sites, although slow natural colonization may occur if the species inhabits suitable adjacent and undisturbed habitats.

A hydroelectric transmission corridor travels through *P. hesperus* habitat between Keremeos and Princeton and maintenance activities may impact sites.

Where undisturbed *P. hesperus* habitat occurs adjacent to the pipeline and hydroelectric corridors, observational data suggest the species is able to disperse into and occupy suitable new habitat in the corridors following construction/maintenance disturbance events and sufficient time has passed to allow the disturbed sites to stabilize (Bennett unpubl. data). For example, *P. hesperus* is recorded in stabilized rocks adjacent to pipeline and hydroelectric corridor access roads at sites 1 and 2 along the Old Hedley Road.

Natural System Modifications (Threat 7)

7.1 Fires and Fire Suppression.

Wildfires occur in the southern third of the province and consume large tracts of forest and grasslands annually in the interior including the Similkameen-Okanagan Regional District (see BC Ministry of Forests and Range 2012c). For example, the 2500 wildfires recorded in BC in 2003 were concentrated in the southern interior of the province and burned large amounts of habitat in the south Okanagan Valley including important *P. hesperus* habitats in the vicinity of Vaseux Lake (British Columbia Ministry of Forests and Range 2012b), McIntyre Road (British Columbia Ministry of Forests and Range 2012a) and Haynes Lease in the mid-1990s. Fires in dispersal habitat destroy individual spiders as well as the cover objects and other habitat that provide protective retreats for them during dispersal. Hot ground fires destroy spiders in their residences.

7.2 Dams and Water Management/Use and 7.3 Other Ecosystem Modifications

Historically, the Okanagan River and many of its tributaries were altered through dam construction, stream bed alteration, and other water management activities. Today approximately 7% of the Okanagan River remains in undisturbed condition (Lea 2008).

It is not possible to quantify the impact of historic water management activities on *P. hesperus*. Within the Similkameen Valley, water storage and hydroelectric dam projects are under consideration at Shanker's Bend (upstream from Oroville in WA) and Copper Mountain (upstream from Princeton in BC). The Copper Mountain site (Garstin 2012) will not impact *P. hesperus* habitat. Shanker's Bend has been a proposed dam site since the 1920s and could have significant impact on *P. hesperus* habitat in Canada. In 2006 the Okanogan Public Utility District began steps towards a dam (Boyer 2009; Washington State Department of Ecology 2011). However, plans for these dam options were shelved in 2011 due to widespread opposition (Washington State Department of Ecology 2011).

Pollution (Threat 9)

9.3 Agricultural and forestry effluents.

The application of pesticides in the McIntyre Bluff and Osoyoos corridor are ongoing. The study of pesticide impacts on spiders began only recently; however, the negative impacts are now well documented (*e.g.*, see review in Maloney *et al.* 2003). The combination of land conversion and operational activities likely renders agricultural areas unusable as dispersal habitat and prevents the migration of individuals and establishment of populations in previously unoccupied suitable habitat.

Geological Events (Threat 10)

10.3 Avalanches/Landslides.

Psilochorus hesperus does not occupy unstable rocky habitats, such as steep talus slopes or areas with frequent falling rock. Most known sites occur in stabilized habitats on the margins of active rock habitat. Summerland Peach Orchard Cemetery is within a steep silt slope surrounded by some residential development and at risk from silt washouts or slumping.

Limiting Factors

Psilochorus hesperus has limited natural dispersal abilities, small population sizes, may be isolated due to the rocky habitat associations, and in crowded populations may exhibit cannibalism.

Number of Locations

There are at least 16 locations of *P. hesperus* in Canada, corresponding to the 16 extant sites: eight in the lower Similkameen Valley and eight in the south Okanagan Valley. One location at Summerland (site 12) is situated in an artificial rock wall within a cemetery and likely a result of human movement. This site is still considered extant and included in the number of locations. An additional site in the Okanagan Valley was converted to agricultural use, and the species is presumed extirpated. This site has not been resurveyed; however, there is a possibility the species could remain within small rocky areas surrounding the agricultural area that have not been converted. Based on search effort data and areas of potential habitat, there are an estimated 5 to 10 additional locations.

PROTECTION, STATUS AND RANKS

Legal Protection and Status

Psilochorus hesperus is not protected under provincial or federal legislation. Invertebrates assessed by COSEWIC as Threatened, Endangered or Extirpated will be protected through the British Columbia *Wildlife Act* and *Wildlife Amendment Act* once the regulations listing these species are completed. The British Columbia *Parks Act* and *Ecological Reserves Act* protect species at risk within these areas, and when *P. hesperus* is assigned a conservation status rank the species will be protected under these acts. The species is a potential Identified Wildlife candidate under the provincial *Forest and Range Practices Act* due to the possibility of rock substrate extraction for road construction.

Non-Legal Status and Ranks

Psilochorus hesperus is provisionally assigned a conservation status rank of N2S2 (nationally and provincially imperilled) in Canada (NatureServe Canada 2010). The species has not been assigned a global conservation status rank. The 2010 Canada and BC General Status rank for *P. hesperus* is "2" (may be at risk) (Wild Species 2012). The species has not been assigned a global (Natureserve 2013) or provincial conservation status rank (British Columbia Conservation Data Centre 2013). The species has not been assigned a conservation status rank at the national or subnational level in the United States. There are currently no international laws that protect this spider in other parts of its global range.

Habitat Protection and Ownership

Psilochorus hesperus is recorded within three provincial protected areas: Haynes Lease Ecological Reserve, Bromley Rock Provincial Park and South Okanagan Grasslands Protected Area (East Chopaka Site); one private conservation area (Skaha Conservation Area owned by The Nature Conservancy); and one federal protected area (the Northeast and Southeast Uplands Units of the Vaseux-Bighorn National Wildlife Area).

Sites on provincial Crown land are managed under the British Columbia *Forest and Range Practices Act*; however, the species is not listed as Identified Wildlife under this act and thus not protected (*e.g.*, Old Hedley Road sites 3 and 4 [other than at Bromley Rock], Kilpoola Lake [site 7], and Ashnola River [site 17]).

A few sites are managed by First Nations (Site 17 Ashnola River and Site 11 Osoyoos Indian Reserve 1) or are private property (*e.g.*, Site 10 Osoyoos East Bench and Site 12 Summerland Peach Orchard Cemetery).

A Regional Growth Strategy (RGS) has been developed (Regional District of Okanagan-Similkameen 2012) that provides guidelines and policies for the protection of sensitive ecosystems. The document focuses on wetland protection and includes caveats such as "the right to farm". However, the conservation value of the lower Similkameen and south Okanagan Valleys as a national biodiversity hotspot is well known, and the Strategy Steering Committee includes representation from Environment Canada, Natural Resources Canada, and the BC Ministry of Environment.

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BIOGRAPHICAL SUMMARY OF REPORT WRITER

Robb Bennett holds MSc and PhD degrees earned from the study of spider taxonomy and systematics. He is a Fellow of the Entomological Society of Canada and currently works as a research associate at the Royal British Columbia Museum, and an entomology/arachnology and invasive species consultant. Previously he worked as a forest insect management specialist, mentored over two dozen graduate and an undergraduate student, served on a variety of professional administrative committees and boards of directors, and was a member of the COSEWIC Arthropod Specialists Subcommittee and Editor-in-Chief of *The Canadian Entomologist*.

COLLECTIONS EXAMINED

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